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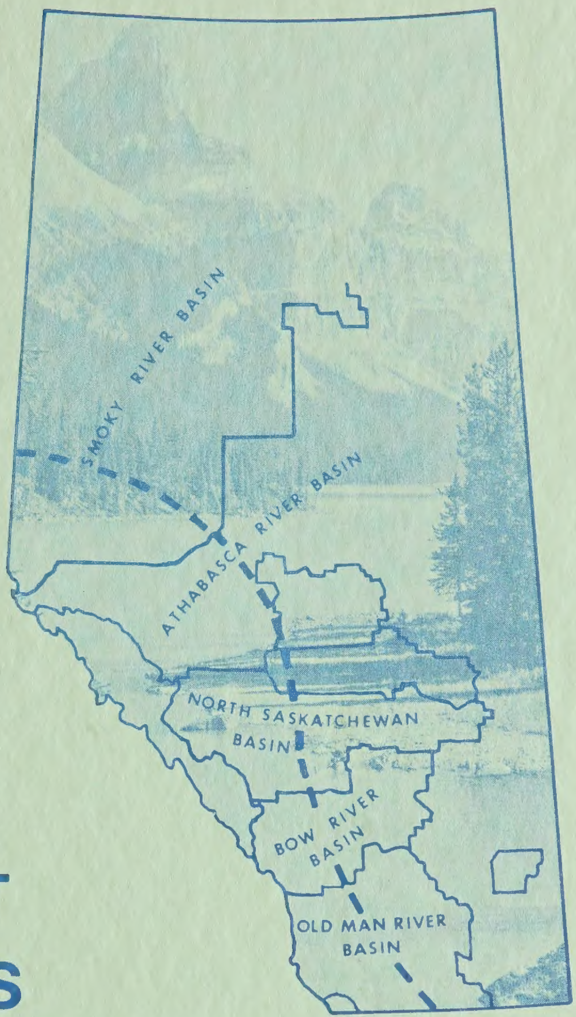
Public Hearings



CURRENT STATUS REPORT on Alberta's EASTERN SLOPES

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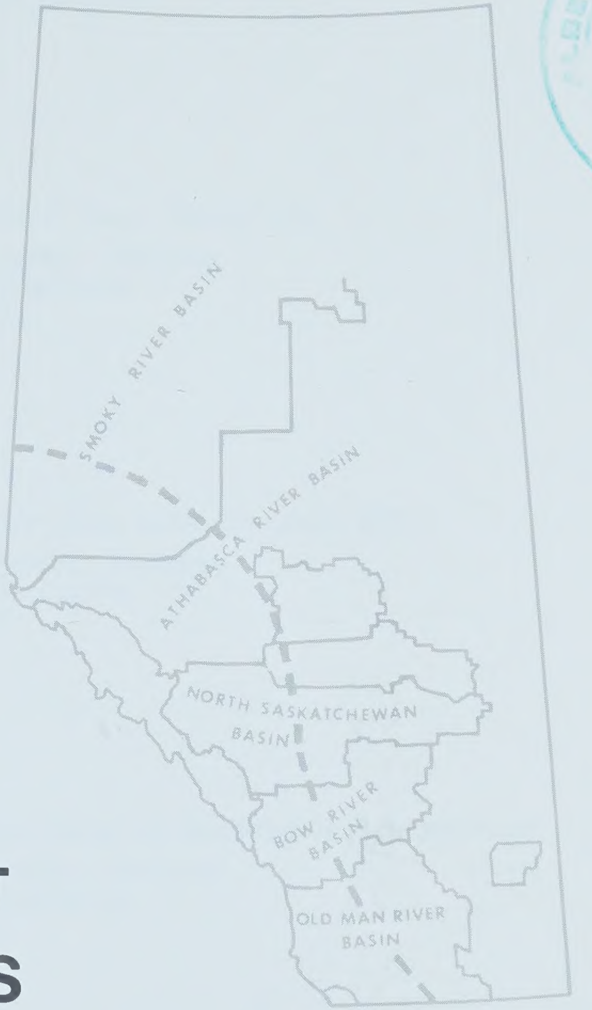

CURRENT STATUS REPORT on Alberta's EASTERN SLOPES

ENVIRONMENT CONSERVATION AUTHORITY
9912 - 107th Street, EDMONTON, ALBERTA, T5K 1G5

APRIL, 1973

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1. INTRODUCTION

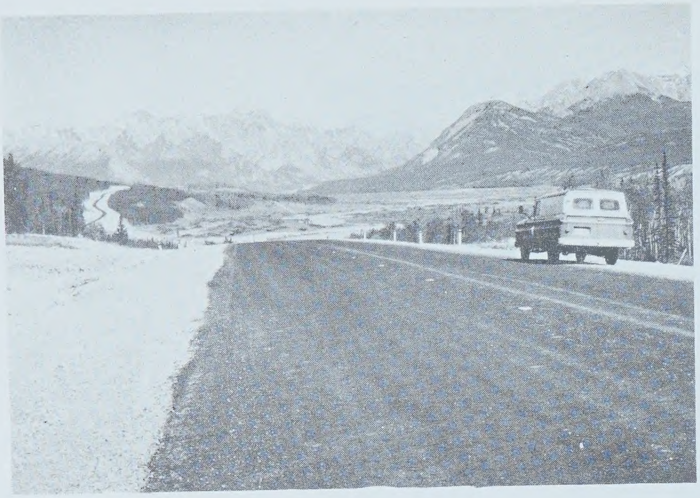
The material contained in this Bulletin is presented in order to outline for those interested in the public hearings on Land Use and Resource Development in the Eastern Slopes, the general situation with regard to geographic, physiographic, ecological and land use and management situations on the East Slopes of the Rocky Mountains in Alberta. The 255,285 square miles of Alberta extends from 49° to 60° north latitude and from 114° to 120° west longitude for the northern half of the Province. In the southern part of the Province, the western boundary is the height of land of the Rocky Mountain Cordillera running from the Canada/U.S. border to the point where the crest of the mountains intersects the 120° west longitude line. There are ten easily defined ecological regions in Alberta covering the greatest diversification of types in Canada. (Figure 1).

The five major river basins chosen for detailed study (Athabasca, Smoky, North Saskatchewan, Bow, Oldman) cut across three of the ten ecological regions. In addition, these basins intersect or pass through a major physiographic region as well. From the crest of the Rocky Mountains in the south it is a relatively short distance down the Oldman River Basin to the midgrass or even the shortgrass prairie. In the north, the mountains and then the foothills to the east of Jasper National Park comprise a much more extensive area. Because of changing physiography and because of the three ecological regions covered by the five study areas, some consideration will be devoted to physiographic and ecological changes through the five study regions, as well as their geographical location. Thus, the Boreal Cordilleran Transition (Foothills), as well as the Sub Alpine Forest can be delineated as the two most important ecological areas. In addition however, the Montane Forest occurs as three isolated components of this forest system and has importance for the study as well. The regions for the whole of the Province are outlined in the map shown as Figure 2 to the same scale as that outlined for the river basin study areas; the map has the same approximate line drawn on it as that which is superimposed on the study basin map, in Bulletin No. 1, previously published by the Environment Conservation Authority.

As a management policy, the Province has been divided into two zones, referred to as the Green zone and White zone. The Green zone lands are not available for permanent disposition, while lands in the White zone are already settled under private ownership, although in some parts of the Province large acreages of Crown land still remain in the White zone.

Because of the great diversity in physiographic, geological and climatic conditions, which has resulted in the establishment of ecological regions, the lands of Alberta present very significant management opportunities for multiple resource development, while at the same time they pose very great problems in resource allocation and integrated development. The ecological regions shown on the map are the result of climatic variation, influenced strongly by physiographic and geological conditions. Elevations range from 1000 feet above sea level to 12000 feet; temperature may vary from -60° Fahrenheit to more than 100° Fahrenheit; annual precipitation may vary from 12 inches in the south east corner of the Province to 40 inches in the Rocky Mountain Cordillera. The length of the growing season varies from fifty days or less at higher elevations to more than 120 days in southern Alberta; the summer climate of Alberta is generally temperate, while the winter climate is typically continental, although areas adjacent to the southern Rocky Mountains and Grande Prairie are subject to frequent Chinook winds which provide strong modification of winter cold spells and snow cover.

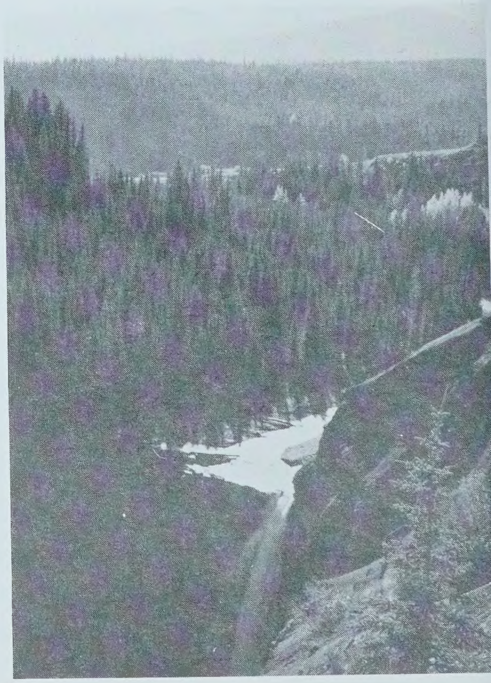
Largely because of the abundance of resources, as well as their diversity, great diversity is also reflected in land use and resource development in the east slope areas. As indicated in Bulletin No. 1, "Land is now used in the Eastern Slopes or is proposed for use for such purposes as tourism, summer and winter recreation, urban development, forest utilization, mineral resource industries, surface mining, oil and gas development, underground coal mining, agriculture, watershed conservation, domestic water supplies, hydro-electric power development, wildlife and fishery management, wilderness and natural areas, institutional use (charitable and religious groups), archaeological sites, research, etc." As well as the Provincial Crown lands of the general geographic area, many Indian Reservations exist and also occurring largely in the Sub-Alpine and Alpine regions are the world-famous National Parks of Canada. In the report to follow, both verbal and visual descriptions of the land forms, vegetative cover, watershed and renewable and non-renewable resources will be provided. It is hoped that the information on Eastern Slope resources, together with a description of land uses and their relationship to physiographic and ecological factors, will be used to provide increased public knowledge prior to the public hearings, as well as to provide a basis for increased public participation at the hearings.



bighorn dam site

leyland mtn. south of luscar

open pit at coleman



bow river fall

2. ECOLOGICAL ZONES

2.1 Foothills (Boreal Cordilleran Transition) *

2.1.1 Geographic Location; Physiography; Drainages

The Foothills region generally extends along the East Slopes of the Rocky Mountains from the James River Drainage in the south to the Birch Hills in the north. On the west it is bounded by the Rocky Mountain Sub-Alpine and on the east by the Aspen Parkland and mixed wood forest. It includes the Pelican and Caribou Mountains, and is shown on Fig. 1 as Region 4. The factors used in delineation of this region are primarily elevation and physiography in the north and west, and the vegetation-climatic-soil type boundary on the south east.

The lower Foothills section of this zone represents an area of transition between the Boreal and Sub-Alpine regions. Most of it is located in the Rocky Mountain Foothills with isolated outlying areas containing the same type of vegetation as the main body. Generally these elevations range from 3000 to 4000 feet in the Foothills. The area is traversed by numerous watercourses and major rivers which cut the landscape into typical river break zones with steep to precipitous slopes. Traversing the area from east to west, the level topography assumes an undulating character and becomes increasingly steep toward the boundary where it meets the Sub-Alpine at the western extremity. The outlying areas, such as the Clear Hills, Swan Hills, Pelican Mountains and Caribou Mountains, which are not considered in this study are delineated primarily on elevation and are separated spacially from the main body of the Foothills. Numerous sub-basins drain the Foothills, but for the purpose of the public hearings on Land Use and Resource Development in the Eastern Slopes, five major regions have been delineated:

1. The Oldman River Basin
2. The Bow River Basin
3. The North Saskatchewan River Basin
4. The Athabasca River Basin
5. The Smoky River Basin

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* Region 4 on attached map.

2.1.2 Climate; Soils; Vegetation

The climate of the region fluctuates from sub-humid to humid. The average precipitation is approximately twenty inches per year and generally increases from the eastern border toward the mountains. Total annual precipitation might suggest semi-arid conditions; however, two-thirds of the precipitation falls during the spring, summer and fall months when it can be used by vegetation. The region is characterized by comparatively low rates of evaporation, which provide for a favourable soil moisture balance.

Mean annual temperature throughout the whole region is approximately 35^0 Fahrenheit. Summer temperatures at all stations are comparatively warm, reaching a mean of about 60^0 Fahrenheit in July. Where Chinook conditions are frequent, e.g., between Jasper and Hinton, between Banff and Calgary, and between the Crowsnest Pass and Lethbridge, mean annual temperatures are about 2^0 higher than the average for the rest of the region. The length of the frost-free period is an important consideration in determining any potential use for the area. Killing frosts can be expected in some portions of this region in almost any month of the year. The length of the cropping season is highly variable. Towards the north within the region, the effect of increasing elevation on the temperature gradient becomes increasingly significant. Many of the Foothills areas below the mountains lie in a "Chinook Belt". Chinooks are the result of subsiding warm air masses from the Pacific, at wind velocities averaging about 25 m.p.h. They occur frequently during the winter, providing certain measures of climatic relief. Chinooks may well be a key factor in planning land use, because Chinooks may affect the winter standing snow levels as well as the hydrologic cycle as a whole.

Soils of the region vary considerably, depending on parent material, physiographic position and existing vegetation. The region encompasses the dark grey, dark grey wooded, grey wooded, brown wooded, acid brown wooded, gleysolic, and organic soil groups. The grey wooded soils occur in areas with a dry, sub-humid to humid climate under fairly continuous tree cover. Some crops can be grown on these soils, and under good management their productivity is generally high. However, this group of soils is basically low in nitrogen, phosphorus and potassium in the surface horizons. Because of the climatic regime and vegetation under which these soils develop, production of soil nutrients is low. Initial high crop yields are not uncommon, but this productivity is unable to be maintained unless other management factors such as fertilizers or special tillage practices take place. Brown wooded and acid brown wooded soils occur in areas with a sub-humid climate and where there is a tree cover. Organic soils are those which have over twelve inches of a peat surface. Uses of grey wooded, brown wooded and acid brown wooded and organic soils all must be very carefully considered, and all must take account of the flow of benefits from the existing vegetation for other purposes.

Characteristic vegetal cover of the Foothills has an abundance of aspen mixed with varying proportions of balsam poplar, white birch, white spruce, and balsam fir. Low areas and upper water catchments develop black spruce and tamarack vegetation under muskeg conditions. Lodgepole pine occurs along the fringes of the drier till soil ridges and mixes with white spruce on the plateaus of the higher hills especially on clay soils. Aspen regenerates readily after disturbances such as fire, but in most areas it is gradually replaced through succession by white spruce, as aspen becomes older and degenerates. At the higher elevations the coniferous species which dominate are the lodgepole pine, Engelmann spruce, black spruce and tamarack; deciduous species include balsam poplar, quaking aspen and white birch, with understory of blueberry, hazel, saskatoon and birch. Ground vegetation includes a variety of moss grasses and mat-forming plants such as lichen. Dominant grasses in the mountain meadows and timbered areas include species of reed grass, brome, bluegrass, red top, slough grass and fescues. Meadows occur frequently, especially on alluvial soils deposited as river terraces and flood plains.

2.1.3 Renewable Resources.

Renewable resources in the Foothills portion of the Eastern Slopes may be placed in five broad categories, i.e., water, timber, wildlife, fish and agriculture. All these renewable resources are interrelated in one way or another and it would be incorrect to use the brief descriptions of each which follow in isolation from the other resources. The production of high quality water on the Eastern Slopes places water in the paramount position in the renewable resource mix. Virtually all significant population centres in the Province depend to a considerable degree on the major stream systems which cut through the Boreal Cordilleran Transition. Furthermore, the influence of the major drainages is felt not only in Alberta, but also in the other prairie provinces to the east. Consequently, water quality should have the highest priority over all other potential resource values in the Foothills region. Such a priority also is compatible with all other high quality renewable resource management.

2.1.3.1 Water

Water regimes may be regulated by alteration in vegetation in upstream areas, through silvicultural, soil stabilization or other hydrologic techniques. Industrial activity, such as surface mining, drilling, sand and gravel removal, and timber management could have immediate effects for downstream water quality and quantity. Perhaps the most severe and immediate effect which has been noted in the Alberta Foothills has been caused by a variety of road construction including that for timber management, oil and gas exploration, coal exploration and development, as well as construction for primary access routes and highways. Certain rivers or portions of them may be unique and suitable for reservation as "wild rivers". Flood plains and valley bottoms near streams may be critical for wildlife or fish habitat. In summary, the greatest care and attention should be paid to the potential of the water catchment basins in the Foothills region of the Eastern Slopes.

2.1.3.2 Timber

Timber is the key renewable resource of the Foothills zone and a very significant proportion of the commercial stands for the Province is found in this region. In comparison to most other regions of Alberta the timber in the Foothills area is generally faster growing and easier to regenerate. Timber harvesting operations in the Foothills region through good management can perpetuate and improve the growth of timber stands on a sustained yield basis. At present, the major cutting of timber has approximately balanced the loss previously attributed to fire. The management, harvesting and reproduction of the timber crop can greatly affect the existing interdependent soil-water-vegetation relationships of the region, as well as the development and management of recreational range and wildlife and fish resources.

In addition to providing a great proportion of the commercial timber land in the Province, the Foothills region also provides summer habitat and key winter range for both big game and small game animals. In this region also occurs most of the best stream fish habitat in the Province.

Timber management, under ideal conditions, is compatible with all other renewable resource management. Production of water, wildlife, fish and grazing for both domestic and wild ungulates can be enhanced with good timber management. One of the chief impacts of timber management practices will be made on the aesthetic qualities of the region, and the most likely damages arising from timber management practices will occur from road construction.

2.1.3.3 Wildlife

The geographic location of the Foothills of the Rocky Mountains, and their close proximity to the high mountain Eastern Slopes has resulted in climatic and vegetal characteristics which, along with the physiographic relief,determine to a considerable extent the native fauna of this region. Characteristically, both altitudinal and physiographic variations provide a multitude of habitats in which reside most of the species found on the higher mountains to the west as well as the Foothill-Plains transition to the east. However, some species are more noticeable than others and some have greater impact on the viewer, or a greater importance for the individual, depending to a considerable extent on knowledge of the area as well as particular locations visited. Game animals have always had special significance to residents of Alberta both in prehistoric times and after the arrival of Europeans. This is no less true today than in the past. Some of the species more readily noticed in the Foothills region are mule deer, white-tailed deer, moose, Rocky Mountain elk, and in special localities, Rocky Mountain goats and Rocky Mountain sheep. Similarly, large carnivores which are found in the area are grizzly bear, black bear, cougar, coyote and wolf. Representative of the fur-bearing mammals include squirrels, mink, marten, weasel, beaver and muskrat. Some of the smaller rodents common to the area are meadow voles and white-footed deer mice, as well as more conspicuous species including badger and marmots. Depending on the time of year, well over one hundred species of birds may be found throughout the Foothills region. Cyclic populations occur of the well-known game birds such as blue grouse, spruce grouse and ruffed grouse, as well as a variety of waterfowl including most of the common species which inhabit the more productive prairie lands.

The few species of mammals and birds listed above obviously do not encompass or even approximate a complete description of the Foothills fauna. As well, it would be a mistake to overemphasize only the species considered as game, because many thousands of Albertans enjoy viewing both the game and non-game species of mammals and birds. In summary, the terrestrial and avian wildlife of the Foothills region includes a great variety, and for some species, very large numbers of animals. The Foothills fauna is of economic importance to some segments of the community and has very strong aesthetic appeal as well.

2.1.3.4 Fish

The Foothills region has a large number of streams which support fish. The condition of fish habitat in the Foothills streams varies from pristine to badly debilitated. Generally speaking, stream conditions improve from west to east throughout the Foothills region, perhaps as a natural result of decreasing activities of man which seriously may affect stream habitat. Within the Foothills region are several hundred miles of the best and most productive streams in the Province. Present too in this region are a significant number of productive lakes which provide first-class habitat for the more desirable game species of fish. Many of these did not originally contain fish, but have been planted with hatchery fish generally of the family Salmonidae.

The Foothills region has by far the most extensive stream fish habitat of quality available in the Province of Alberta. In general, in the mid and upper reaches of Foothills streams are to be found the salmon and trout-like fish (cold water species), while warm water species are more common to the lower reaches stretching into the transition zone towards the prairies.

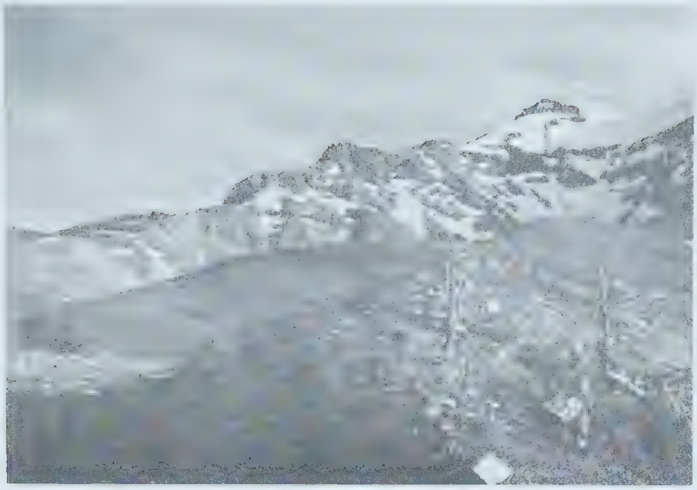
Most species of fish in Alberta have relative tolerance to a variety of physical-chemical conditions. Nevertheless, various species of fish are healthier, and are more successful in maintaining significant populations under conditions which are preferred for the species in question. Thus, the relatively clear, cool, silt-free streams common to the Foothills area, particularly in the forest reserves, produce conditions under which the salmon or trout-like fish best thrive. Well-known game species such as the cutthroat and rainbow trout, the dolly varden char, the mountain whitefish as examples of fishes native to the Province, and the brook trout (an introduced species), are widespread throughout the streams and lakes connected by streams in the Foothills region. As mentioned earlier, the same species may also have been planted in the lakes without stream connections. Non-game species, such as sculpins and suckers also are relatively successful in the mid to upper reaches of many Foothills streams. Pike, perch and similar warm water species are successful only where the temperature is generally high enough to approach their preferendum and to offer a reasonable chance of successful reproduction. These conditions do not often occur in the mid and upper reaches of Foothills streams, and thus the warm water species are generally restricted to the lower portions of Foothills streams in the transition between Foothills and Prairie Parkland.

Stream habitat in the Foothills region of Alberta represents the best and most productive of stream conditions generally to be found anywhere in the Province. As a consequence, the Foothills stream habitat resource has an extremely large and valuable capacity to provide recreation for Alberta citizens and visitors alike. Foothills lake habitat, while not as extensive as that of the streams, nevertheless is also productive and of high quality. Stream habitat is extremely vulnerable to environmental alteration such as removal of tree cover and consequent warming of stream waters, construction of roads, with the possibility of siltation, surface disturbance caused by seismic or other geophysical operations, runoff from surface disturbance caused by strip mining and similar physical surface disturbances. In general, disturbances which affect water quality in any manner mentioned earlier, likely will be detrimental to fish habitat in the Foothills region.

2.1.3.5 Agriculture

In general terms, agriculture along the lower Foothills has not been economically rewarding. The number of farms has declined steadily; however, the average farm income has increased but is still much below the provincial average. At least two-thirds of the farm operators supplement their incomes with earnings outside the agricultural industry. The production capability of the soil is well below that of established farms in the better soils zones of the province. Climatic conditions can be much more severe and produce a much shorter frost-free period. It is extremely difficult to establish boundaries between the arable and non-arable land because of the marginal characteristics of soil quality and the highly variable climatic conditions.

Grazing by domestic livestock has been established for long periods and all suitable grazing areas within the forest reserve are being utilized. This utilization of grazing land can be a problem in some areas because of the competition for forage between domestic livestock and wild animals. This particular competition has been a subject of considerable concern in discussions between ranchers and outdoorsmen.



cadomin

cheviot mtn. mountain park

rock quarry cadomin

leyland mtn. cadomin

2.2 Sub-Alpine and Alpine (Area above 5000 feet)*

2.2.1 Location; Physiography; Drainage.

This region extends from the United States border at Waterton National Park along the political boundary with British Columbia and north to the headwaters of the Wapiti River. Its eastern boundary is approximately the 5000-foot contour. The factor used to determine the extent of this zone is primarily elevation.

The lower areas represent the change from the foothill classification to high mountains. The tree line, representing the upper limits of tree growth, is included within this zone. The elevations at the crest of the zone exceed 10,000 feet at mountain peaks. Topographically, the upper reaches of this zone are extremely rough with steep inclines and deep valleys.

The bedrock geology includes alternate strips of Triassic, Jurassic and Lower Cretaceous materials interspersed with Devonian, Mississippian and Permian materials.

2.2.2 Climate; Soils; Vegetation.

The climate of this zone is very poorly defined since most of it is difficult to reach and no locations have measured meteorological elements for a sufficiently long period of time to provide statistically reliable data. Accordingly, precipitation amounts and temperature regimes, the most important elements, are not available. However, the Meteorological Service of Canada carries out daily measurements of various data at high levels. From this, it is known that temperature variations may be from 70^0 F. in summer to -50^0 F. in winter. Freezing temperatures occur in every month of the year.

Summer drought and soil moisture deficiency during the growing season is common in well-drained valley bottoms and is a prime factor in determining plant growth. Winter weather is dominated by the Continental Arctic Air Mass which is overlain at varying altitudes by warm maritime air masses. The warm maritime air frequently is dried through lifting and

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* Region 5 on attached map.

and precipitation on the west side of the mountains and through downward motion and compression becomes very warm, giving rise to the Chinook winds. These warm dry winds give rise to rapidly fluctuating temperatures and snowmelt which exposes vegetation to severe temperature conditions.

Soil distribution in this zone varies from none on steep high slopes to a few inches at slightly lower altitudes and finally to depths of as great as 100 feet. Glacial and alluvial material washed down and deposited in stream shore lines is not highly productive. Soils formed under pine forests are mostly of the grey or brown wooded type, are frequently highly leached and deficient in nutrients. Some organic bog soils are found in poorly-drained bottom areas.

Vegetal cover shows marked differences between the southern portion and the areas to the north. Over 100 species of plants which occur in the south (Crowsnest-Waterton) are not found in the north. This, no doubt, is due to significant changes in climate from south to north.

Coniferous forests reach up to varying altitudes and their presence is dependent upon soil cover and climate. The coniferous forests described earlier in this report need no further specification, except to note that growth rate and size diminish with altitude. Between the coniferous forests and the barren peaks of the mountains is a zone in which herbaceous plants exist but in which no significant tree growth is present. This is the biologically fascinating and delicate alpine tundra. The environment is harsh and summers are very short, but special growth forms have adapted to these conditions to produce colourful vegetal cover. Prostrate forms grow along the surface, cushion plants wedge themselves in cracks and leathery heavy-leafed forms whose special adaptation conserves water are typical vegetal types. Among the common species are mountain avens and snow willow. Despite the harsh conditions, the alpine tundra growth produces nutritious vegetation for a surprisingly large variety of mammals and birds. Of special significance is the short growing season and the tundra's slow response to recover from unnatural environmental damage.

2.2.3 Renewable Resources.

The renewable resources of this zone can be classified in four main categories: water, timber, wildlife and fish. In addition, some limited grazing can be classified as agricultural.

2.2.3.1 Water

The cyclic distribution of summer rainfall migrates from south to north during the progression of seasons from spring to fall. Winter precipitation is highly variable due to the effects of terrain. Accumulated snowfall and consequent spring runoff are strongly affected by dry warm Chinook winds which have the capacity to remove snow cover at high rates. The area generally is an important part of the source of the river drainage systems. In the upper reaches, the activities of man are still not a large factor in affecting water quality or quantity. However, in the lower elevations, many of man's activities affect the quality of water. Removal of vegetation, surface disturbance of soil cover, roadways and artificial drainage systems all contribute to the degradation of water quality. Water is such an important element in the total environmental picture both to the immediate area and to downstream uses that its management should take precedence over all other activities.

2.2.3.2 Timber

Timber in this zone is usually non-merchantable, slow growing and very difficult to regenerate. The growing season is short, the topography rugged and the soil types too marginal to sustain economic yields. In essence, the thrust of timber management in the alpine zones must be directed to the preservation of watersheds so that there is no deterioration in water quality or yield.

2.2.3.3 Wildlife

The animals and birds which inhabit this zone show a very great variety since there is a highly variable climate, soil condition and vegetal cover. Mule deer, moose, Rocky Mountain elk, sheep and goats are the major ungulates. The carnivores are represented by grizzly and black bear and cougar. Smaller mammals are represented by the marmot and squirrel. This by no means is a complete list. Blue grouse, spruce grouse and white-tailed ptarmigan inhabit various portions of the zone.

It is most important to recognize the migratory nature of most ungulates and carnivores. The competition for forage by the ungulates causes migration from higher to lower altitudes with seasonal progression. As a result, many of the ungulates move through all zones. In the alpine tundra regions, the white-tailed ptarmigan is a permanent resident and like its Arctic cousin adapts to seasonal changes with plumage change. Goats and sheep are residents which prefer the alpine tundra, as does the grizzly bear, mainly to escape the predations and disturbances of man.

2.2.3.4 Fish

In general, the fisheries section of the foothills region is applicable to the alpine region, except for the following difference. With increasing altitudes and steeper slopes, the upper reaches of watercourses cannot be entered by fish. In the area which fish can reach, water temperatures are very low, thus excluding all warm water species. Low temperatures and short seasons prevent rapid production of food supplies in lakes and growth of fishes is very slow. High altitude lakes freeze over for long periods with the result that oxygen supplies may be reduced by snow cover which cuts off light to oxygen-producing plants.

2.2.3.5 Agriculture

Agricultural activity is totally restricted in the alpine zone except for some areas of grazing which were previously mentioned in the Foothills section of this report.

drywood creek

drywood creek

drywood mountain

southwest of cardston

2.3 Montane Forests *

2.3.1 Location; Physiography; Drainage

The Montane Forest region is generally an elevated area between the Sub-Alpine and the plains with elevations generally 4000 to 6000 feet. The factors used to delineate the zone are physiography, vegetation and biological components. It is a relatively narrow strip which includes the Porcupine Hills, a portion of which is unique because it has never been glaciated. The region is cut up by a number of preglacial rivers which drain eastward. The Livingstone River forms the boundary of the central portion of the zone. Isolated portions of this zone occur in the Bow River near Cochrane and the Athabasca River at the Jasper Park boundary. Drainage of this zone is accomplished by the Waterton, Castle, Crowsnest and Oldman Rivers and tributaries of the Highwood River for the Porcupine Hills. The other portions of the zone are drained by the Bow, Oldman and Athabasca, the latter being the only one which runs to the Arctic.

2.3.2 Climate; Soils; Vegetation

Again, because of geographic location and accessibility, there is a lack of weather data which makes it necessary to generalize the climatic conditions. Precipitation in the area on an annual basis averages about 24 inches. During the growing season (April to August), 12 to 14 inches of rain can be expected. Winter snowfalls average 60 to 80 inches. Maximum rainfall in one day can exceed 4 inches as calculated from stream flow data.

The zone is highly and frequently influenced by Chinook winds. Gale force winds are present in both summer and winter. The Chinook winds may provide 30 to 40 days with temperatures over 40^{0} F. in the winter, while in the summer an average of 20 days with temperatures above 80° F. can be expected. There is an evapotranspiration potential of 18 to 20 inches which is never achieved because of a moisture deficiency of 6 to 8 inches.

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* Region 6 on attached map.

Soils vary from bare rock to shallow soils of the grey wooded or acid brown wooded types in lower slopes to the bottom lands organic and alluvial types. Some finer textured soils, especially on the exposed southwestern slopes, are highly susceptible to wind and water erosion. Special care should be given to management of steep slopes with thin soils and deficient moisture where the vegetal cover is very fragile.

The vegetal cover of the Montane Forest as it occurs in Alberta is characterized by Douglas fir, lodgepole pine, Englemann spruce with some limber pine on the foothills and aspen in the area bordering the grasslands. Shrubs and herb-types are better indicators of the zone and include raspberry, sticky currant and Oregon grape. Other plant types which occur are kininick, horizontal juniper, aspen poplar, shrubby cinquefoil, bluebunch wheatgrass, pussytoes and sweet vetch. Within the interior valley and near the grassland fringes, the occurrence of northern wheatgrass, western porcupine grass, thickspike wheatgrass, rough fescue, sedges and other forbs are common. The distribution of vegetation is regulated by depth and types of soil, available moisture, strong winds and the presence and use by game animals.

2.3.3. Renewable Resources - Montane Forests

Montane Forest areas are similar to the Foothills zone with respect to the presence of renewable resources. Special factors which influence renewable resources are variability of precipitation, previous influences of man and his activities and the competition for land use.

2.3.3.1 Water

In this region, the Oldman, Waterton and Belly Rivers together with tributaries of the Bow and St. Mary's Rivers form the major drainage structure. Some special conditions along these rivers and streams require extra attention in management practices. The immediate areas close to these rivers are frequently subjected to natural damage because of unstable soils, rocks, devastation by fires and water erosion from flash floods.

Recurring washing and silt deposition occur naturally and any incompatible environmental use would aggravate an already difficult problem. Few of man's activities can be tolerated in this special area. Many of the smaller streams cannot tolerate recreational facilities for lack of water; nor can livestock be allowed to use these stream banks without causing damage to the watercourses. All of the renewable resources are highly dependent upon the water availability and its quality so that first consideration must be given to water even at the cost of exclusion of other activities. Any proposed change in the streamside or watercourse areas to facilitate irrigation, transportation or recreation constitutes a serious threat to the ecological stability of the total environment.

2.3.3.2 Timber

In Alberta, the Montane Forest is typified by Douglas fir, lodgepole pine, Englemann and white spruce with some limber pine on the lower elevations and aspen at the contact with lower grasslands. The area is frequently subjected to fires of natural origin which leave a mix of vegetative cover in varying stages of succession.

Lumbering activities have been carried on in the Montane Forests for over 50 years and still continue. The volume of timber taken is low and consists primarily of old, low-grade Douglas fir. Timber management practices have prevented any great environmental degradation and controlled cutting in specified areas of this zone may continue.

2.3.3.3. Wildlife

The ungulates which inhabit this zone are white-tail and mule deer, moose and Rocky Mountain elk. The major carnivores are the black bear, coyote and bobcat. Smaller animals are represented by meadow voles, white-footed deer mice, red squirrels and Columbia ground squirrels. Populations of ruffed and sharp-tail grouse are prevalent,with Hungarian partridge inhabiting the lower elevations close to cultivated areas.

This zone especially demonstrates the direct influence of vegetal cover on animal distribution. The ecological relationships which exist between fire and vegetation and distribution of animal populations are critical. Openings caused by fire create a grass-sedge-shrub combination which provides excellent habitat for large ungulates for 5 to 30 years. Mature coniferous forests are generally of low productivity for wildlife since the lower levels of vegetation are not good forage producers. By the same token, the effect of logging and land clearing (and especially that which is accomplished through the use of aerial spraying of defoliants) on the productivity of suitable browse is strong.

An outstanding resource of this zone is the Rocky Mountain elk. A herd of over 1000 of these large animals is seasonally migratory from Sub-Alpine areas into the winter ranges of this zone. This large herd has been the subject of considerable attention by government administrators, politicians and private enterprise. This elk population is well documented as intensive surveys on an annual basis are made.

The moose population is not high since their habitat is primarily restricted to coulee bottoms and the thick cover of the tributary rivers. There is a need for special management practices in relation to the moose.

This zone is most important for its animal resource. Excellent climatic conditions and a high productivity of suitable vegetation combine to make this zone the most favourable in the province for wildlife production. Any future plans for the area should give prime consideration to wildlife uses.

2.3.3.4 Fisher

The fish potential in the zone is described as excellent. Good quality cutthroat trout populations can be sustained throughout the watercourses if the preservation of these watercourses is given the constant protection required. Currently, grazing practices along stream courses cause a degradation in water quality and protection is needed. In addition, the pressure of sports fishing is higher in this area than anywhere else in the province. Since artificial plantings are not possible in streams, the population of fish must be regenerated naturally and can only be sustained at maximum levels with good watercourse management.

2.3.3.5 Agriculture

Since the early 1870's, portions of this zone have been used for domestic grazing. The effects of overgrazing 50 to 80 years ago are still seen in some of the vegetative communities. Clearly, the annual migrations of large ungulate populations bring about competition for food. The management direction for this zone is to select agricultural uses which do not severely inhibit the production of wild ungulates. The area has been subjected to aerial spraying for defoliation without a good understanding of interrelationships between hydrology and vegetation. Good management practices can accommodate livestock forage on summer range and wildlife on winter range while maintaining good soil and watershed conditions. Watercourses must be protected even to the use of fencing to prevent excessive intrusion by livestock.

3. NON-RENEWABLE RESOURCES

The entire eastern watershed of the Rockies has not been fully explored for non-renewable resources. As man continues his search for the riches buried in the earth, he does so with the hope that unknown resources may yet be hidden in the folds of the mountains. This continuing quest may present a problem since its development may conflict with the aims of conservationists. The known list of non-renewable resources is basically oil and gas, coal, sand, gravel and quarry rock, metallic minerals and our archaeological sites. Each of these resources will be treated on the basis of occurrence through all the zones of the eastern slopes.

3.1 Oil and Gas

No single area within the study zone has escaped petroleum exploration. Exploration activities require the building of access roads and seismic trails. As a result, the entire forested area is criss-crossed with endless roadways and trails of standards which vary because of need and use. This sytem of access routes brought about the destruction of large volumes of timber. In fact it is only recently that timber use by the forest industry equalled timber destruction by exploration activities. Watercourses are disturbed or even rerouted and soil erosion and stream siltation occur.

Once exploration activities are complete, the industry moves into the development and refining field. The first requirement is for the construction of pipeline gathering systems, pumping stations and various refining or processing plants. Pipeline work again requires the clearing of timber with the attendant environmental problems. In addition, these pipeline corridors must be kept clear so that the lines may be maintained and checked for leaks. Ever present is the danger of breaks which may result in oil spills which can have disastrous effects upon the immediate area and widespread effects if such spills should enter the natural watercourses.

The operation of refining and processing plants has caused some serious environmental problems in the past. Various types of noxious gases are vented to the atmosphere and some of these gases are highly toxic. The entire slopes area is typified by hilly country and the valleys, because of the frequent inversion conditions, are highly susceptible to concentrations of atmospheric pollutants. A variety of fluids are also by-products of such petroleum industry activity and some of these fluids are also highly toxic. In general, attempts are made to retain such fluids for safe disposal but often they have found their way into watercourses to the detriment of aquatic life.

As time progresses some of the petroleum resources suffer from recovery problems which require water or gas injection into wells. Pollution of ground water supplies must be guarded against. In addition, water injection requires that large volumes of surface water be pumped underground. The use of surface waters in the eastern slopes may cause environmental degradation because of reduced stream flows or lowering of lake levels.

In the past, there have been recommendations made to consolidate pipeline, roads and power transmission lines in single corridors in an attempt to reduce the endless intrusions upon the natural environment. Judgements on access to and recovery of non-renewable resources should be based upon the economic benefits of non-renewable resources now, as compared to the value of lost renewable resources and the ability to restore environmental conditions so that renewable resources are again fully productive.

It is important to note that the search for petroleum products in the eastern slopes is not over. As time progresses and as energy needs continue to spiral, more exploration will likely be done. Our attention now should be directed to finding ways and means of accommodating this search while causing minimal permanent environmental damage. No doubt too, the need for more and more processing and refining plants in the slopes area will arise. Sulphur extraction operations are a most likely type of future industrial expansion. Very shortly, the Environment Conservation Authority will publish a document which is entitled "Report and Recommendations on the Environmental Effects of the Operation of Sulphur Extraction Gas Plants." The document will contain detailed information for the further information of interested persons.

3.2 Coal

Coal suitable for metallurgical uses is found extensively within the eastern Rockies watershed. It is mainly confined to the foothills regions with some deposits at higher elevations. The known deposits run the full length of the slopes from the Montana border to the areas near Grande Prairie. Historically, mining operations have been carried on for many years in the Crowsnest, Nordegg and Luscar areas. Recently the industry has expanded into the Grande Cache area. In view of the building energy crisis all over the world, it can be expected that there will be increasing pressure to develop these coal resources. It is most important to recognize that the occurrence of coal is continuous throughout most of the foothills zone and that the total extraction of the resource could destroy some of the finest wilderness to be found on this planet.

Extraction methods can be either underground or through surface mining techniques. The method used is decided upon by economic factors. At this time, surface mining is the most economic and as a result, these deposits which lie closest to the surface will probably be developed first. The environmental impact of surface mining in the mountain areas can have serious and permanent effects because of steep slopes, unstable cover and the difficulty of surface reclamation. Soil cover may be replaced but is subject to severe erosion by water and replacement of vegetal cover is most difficult.

Coal, once recovered is often treated or cleaned before shipment in the vicinity of the mine site. These processes give rise to the discharge of various chemicals and fine materials into watercourses which can have a disastrous effect upon fish populations. The Environment Conservation Authority has published a report and recommendations entitled "The Impact on the Environment of Surface Mining in Alberta". Interested persons may contact the Environment Conservation Authority for copies of this publication.

3.3 Sand, Gravel and Quarry Rock

The excavation of sand and gravel within the eastern slopes study area has been mainly confined to the area immediately adjacent to roadways and railroads. The material is used for ballast, base construction and surface compaction, etc. There are in existence extensive reserves of sand and gravel throughout the area. With expanding road construction and upgrading of existing roads, it is anticipated that more pits may be opened.

It should be noted that high quality sand and gravel materials used in the construction industry are normally supplied from deposits near the major cities. As the nearby resources are exhausted, a time may come when supplies in the eastern slopes may become of interest to the construction industry. Poor quality sand and gravel require cleaning and separation. We may look forward to the time when the economics of cleaning and separation versus long distance hauling may dictate the use of high quality depositions in the eastern slopes.

Limestone is a product whose value is determined as much by transportation availability as by any other factor. In the eastern watershed it occurs in exposed Paleozoic strata. Deposits are found at Blairmore, Crowsnest, Heart Mountain, Nordegg and Brule. At the present time, limestone is quarried at Cardston, Cadomin, Cascade, Exshaw, Kananaskis and Seebe. Most frequent use of limestone is in cement production.

Gypsum is found near Head Creek, Kananaskis and at the headwaters of the Smoky River. This material must be of very high quality before it is of important economic value. Again, transportation availability is an important factor in determining economic value. Presently, because of the Resources Railroad, the deposits at the headwaters of the Smoky are getting a lot of attention.

Phosphates are widespread from south of Crowsnest to Jasper. None of the phosphate beds discovered to date is thick enough, continuous enough or rich enough to compete with U.S. phosphate formations. Market growth could stimulate further investigation which may reveal economically viable deposits.

Silica sand is a special high grade sand rich in silica and low in iron. Some deposits of acceptable quality have been found. The best of these are in the National Parks. Silica sand is used in glass making and in fibreglass and various other products similar to these.

Clays and shales used in the production of bricks, structural tile and drain tile are found in the Blairmore vicinity. None of the deposits in the eastern slopes is of sufficiently high grade to compete with deposits elsewhere.

Dimension stone is rock cut to size and finished by polishing. Its value depends upon color, consistency and appearance. In the past, some of this material was used in construction at Banff. It is quarried at Canmore and found along the Spray River.

Dolomite is used in metallurgical processes and is found extensively in the Rockies. Few of the deposits in Alberta have been tested for their usefulness.

3.4 Metallic Minerals

Metal ores are not found extensively within the eastern slopes. There have been some explorations over the years but the results have not been at all encouraging. Early in western history, gold was the centre of interest and attracted much attention from time to time.

The South Saskatchewan, Peace, McLeod, Athabasca, Bow and Oldman Rivers were all worked for placer golds. The biggest producer, however, was the North Saskatchewan River. Early workings began in 1859 or 1860 and the peak production was in 1896. There is still some small production. Total production up until 1966 was about 19,000 ounces.

Silver-bearing formations have been located but none is economically suited to recovery.

Iron deposits of sedimentary origin occur in the slopes. The largest is in the Clear Hills where an estimated 1000 million tons of 31% grade have been located. The deposits are overlain with up to 200 feet of overburden. At this time, tests are under way to see if benefication can economically produce concentrate. Other similar formations exist near Crowsnest Pass where the richest deposits are 25 - 30% iron. At Pincher Creek another estimated 6,000,000 tons is found. Neither of these deposits is suitable for conventional benefication.

3.5 Archaeology

The preservation of historical and archaeological objects is concerned with the physical residue that previous habitations provide and includes identification, collection and preservation. The record which past human habitation leaves is perishable, transitory and often of doubtful ownership. It is important to realize that unless an oral tradition survives, all knowledge of the past is apt to depend on its physical remnants, including of course its written records.

People can attempt to re-create in their imaginations what the societies, cultures and other activities of previous civilizations might have been. A multiplicity of worthwhile activities stems from such exercises including the deduction of cultural implications, written historical or archaeological documentation, construction of historical displays and films.

It should be pointed out that the study area may well contain a wealth of historical and archaeological records which may be subject to permanent loss through the activities of man. The creation of artificial lakes for power projects and excavation for resources may permanently destroy a part of the record of human habitation of our land.

4. THE PUBLIC HEARINGS

4.1 Purpose

From the foregoing, some of the problems of developing an integrated comprehensive resource approach satisfying a multiplicity of objectives are apparent. Many other problems will become clear as the hearings proceed. Never before have we had such an ideal opportunity to examine such a huge resource. The participation of every person is needed, not just to attend the hearings, but to make submissions to the Environment Conservation Authority. Significant input to the hearings will be made by government departments, industry and various associations. Again, those individuals who are truly concerned about the future are urged to be active participants in the formulation of our plan for the future.

The Environment Conservation Authority is preparing as much information for public use as possible. The information centres will have an increasingly large assortment of relevant reading material available. Included in the material will be a series of commercial proposals for various types of developments in the eastern slopes. A separate portion of the hearings will consider these developments.

4.2 Planning Alternatives

Future information bulletins will present the various approaches to the planning process.

4.3 Administrative Structure

Of necessity, a multiplicity of government agencies have jurisdiction over the large number of activities which are presently operative in the eastern slopes. Listed below are those agencies, the authorizing legislation and a brief description of their areas of responsibility.

Eastern Rockies Forest Conservation Board.

An Act Authorizing the Execution of an Agreement Between the Government of Alberta and the Government of Canada, March 31, 1947.

Providing for the conservation of the forests on the east slope of the Rocky Mountains and the protection of the watersheds and the rivers therein.

The Expropriation Procedure

The Expropriation Procedure Act.

Expropriations by companies for pipe lines, power lines, power plants, hydro developments (dams, reservoirs), etc.

Fish and Wildlife - Alberta Fisheries

The Wildlife Act.

Maintenance of a sustained yield of fish to suit the social and economic needs of the people of the Province.

Fish and Wildlife - General

The Wildlife Act

Optimum production level and distribution of wildlife.

Fish and Wildlife - Wildlife

The Wildlife Act

Maintain and improve wildlife population and wildlife habitat.

Foothills Resource Allocation

The Conservation and Utilization Committee

Defining the most beneficial allocation of the resources of the Foothills region.

Forest Land Use.

The Forests Act.

Optimize renewable resource potential of public forest lands, to co-ordinate planning and administration of the use of forest land.

Forestry Construction

The Forests Act

Construction of roads, air strips, bridges and facilities.

Forestry Maintenance

The Forests Act

Maintenance of roads, bridges, air strips, buildings, lookouts and recreational areas; mechanical maintenance of trucks, tractors, graders, track vehicles, house trailers and other trailers.

Geophysical

The Geophysical Regulations

Geophysical exploration licence, geophysical equipment; consent of the owner or occupier, surface disturbances reclaimed.

Green Area Grazing Dispositions - Public Lands

The Public Lands Act

Long-term grazing leases, grazing licences, grazing permits, head tax permits, wild horse round-up authority and hay permits within the permanent management areas of the green zone.

Highways Construction

Department of Highways and Transport Act.

To provide for the development and construction of a system of highways and roads of a suitable standard for the present and projected transportation requirements of the Province by the most effective and economical means.

Land Assembly

The Department of the Environment Act.

Purchase of land for the purpose of environmental conservation or improvement.

Land Development

The Department of the Environment Act and the Water Resources Act.

Land-water relationships, surface water control, watershed conservation.

Minerals

The Mines and Minerals Act.

To dispose of Crown minerals.

Mineral Sales Review Committee

The Department of the Environment Act.

To review and examine all lands being offered for mineral sale.

Mineral Surface Lease - Public Lands

The Public Lands Act

Mineral surface leases are issued to mineral producers who require surface rights in connection with the removal of minerals.

Mines

The Coal Mines Regulation Act and The Quarries Regulations Act.

Safety and working conditions in mines and quarries.

Mines and Minerals Technical

The Mines and Minerals Act

Records of Crown mineral and pipeline locations; prepares land descriptions; drafts maps and sketches; distributes maps pertaining to mineral dispositions, oil and gas producing areas and pipeline locations.

Natural Areas Committee

Deputy Minister of Lands and Forests

To protect natural areas.

Non-Agricultural Dispositions - Public Lands

The Public Lands Act.

A miscellaneous lease may be granted to anyone 18 years of age or over, for a purpose which is not expressly provided for by the Public Lands Act or any other regulation passed thereunder. Examples for which the miscellaneous lease can be issued are residence, recreational cottage, commercial and industrial development, mill sites, plant sites and for the removal of peat moss. The miscellaneous lease may be granted for a term not exceeding 25 years; the term of the lease is based on the amount of investment and other factors. Miscellaneous leases may be renewed for such further terms and conditions as may be prescribed by the Minister.

Oil and Gas Well

The Oil and Gas Conservation Act.

Location of well sites.

Pipelines

The Pipeline Act.

The construction, operation and safety of pipelines for the transmission of oil or gas or water incidental to the production of oil or gas.

Pipeline Agreement - Public Lands

The Public Lands Act

Pipeline agreements may be granted to operators for the purposes of pipelines which they are authorized to construct and right-of-way installation incidental thereto. No annual rental is charged but a lump consideration is payable depending on the value of the land with a minimum of $25 per acre.

Provincial Planning

The Planning Act

Provides means whereby plans may be prepared and adopted to achieve the orderly and economical development of land within the Province.

Quota Reforestation

The Forests Act.

The sustained yield policy; the quota holder has the option of performing the reforestation.

The Right of Entry Arbitration

The Right of Entry Arbitration Act.

A mineral operator is able to acquire the surface of land for or incidental to the removal of a mineral by right of entry; certain expropriations.

Sand and Gravel - Public Lands

The Public Lands Act.

Sand and gravel, clay or marl exploration licences and licences or leases to remove material can be issued on available public land and covers sand and gravel, clay and marl which can be recovered by surface excavation methods.

Silviculture

The Forests Act

The application of silviculture techniques to forest lands for timber, watershed protection, and associated land uses; reforestation.

Strip Coal Advisory Committee

Research Council of Alberta.

To plan and supervise an exploration program to outline near-surface coal reserves in the Plains region of Alberta.

The Surface Reclamation

The Surface Reclamation Act.

The conditioning, maintenance and reclamation of the land used in connection with oil wells, pipelines, mining and quarries.

Timber Management

The Forests Act

Implement approved policies of efficient utilization, sustained yield and multiple use of Crown forest land; forest statistics, economic studies, forest inventories, timber management planning, woods operations, and silviculture activities.

Transportation Planning

The Public Highways Development Act

To plan an overall transportation system to meet the demands and needs of the motoring public.

Water Licencing

The Water Resources Act

The allocation of water to present and future uses within the Province.

Wilderness Areas

The Wilderness Areas Act

Ensuring ecological preservation.

Wild Horse Round-Up Authorization - Public Lands

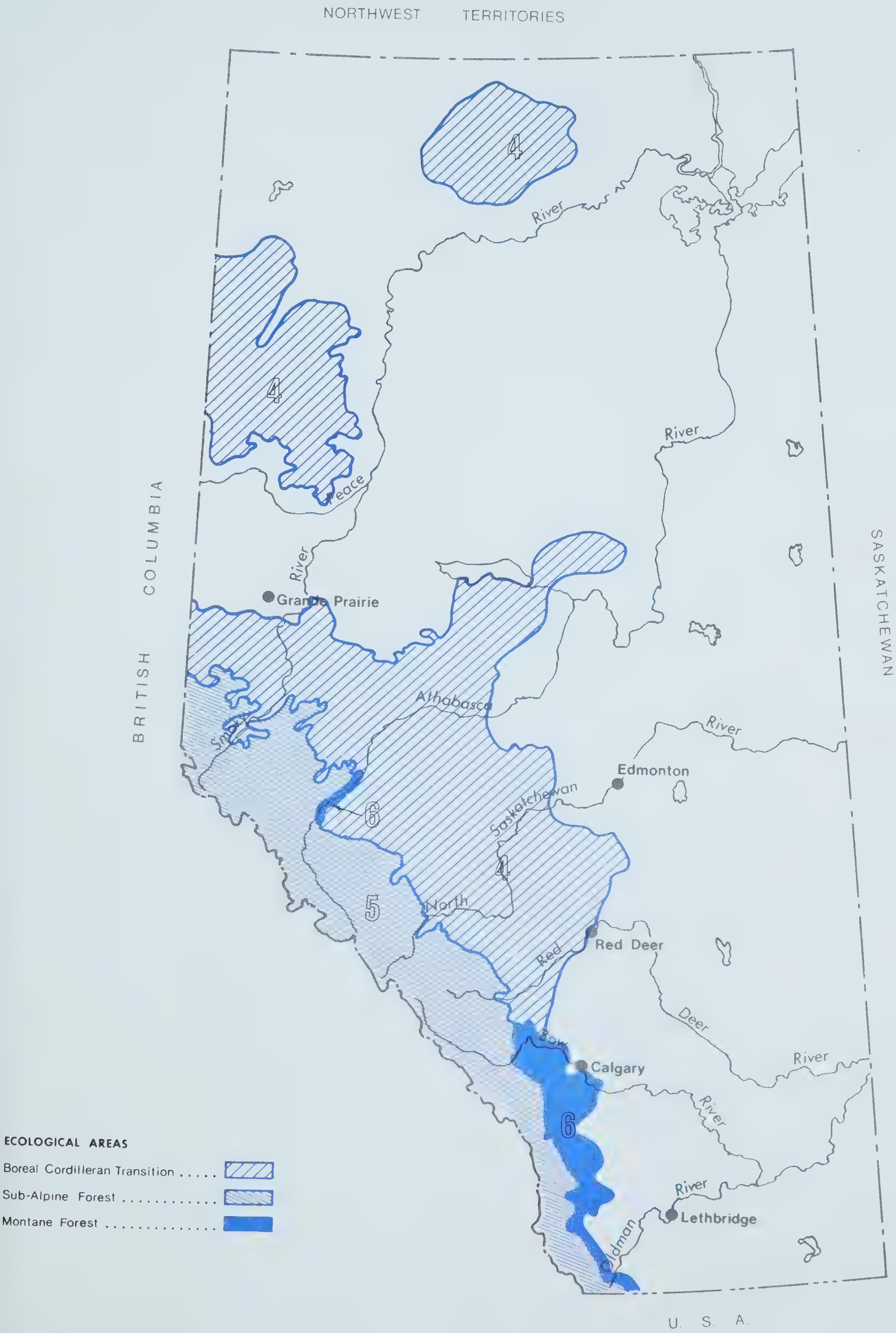
The Public Lands Act

The Department of Lands and Forests, after investigation, issues authorizations for the rounding up of horses which are ranging at large or uncontrolled on vacant public land.

4.4 The Future

Within our own time, world population may increase to levels never before achieved while the individual demands for goods and services may also increase. If economic growth continues, leisure time may become a problem which places tremendous pressure upon recreational activity. The production of renewable and non-renewable resources must somehow be accelerated to respond to the projected demands. Unfortunately, greatly accelerated production of non-renewable resources may cause serious damage to or even a total depletion of renewable resources within certain areas.

Our task, as a responsible society, is to devise a set of plans and management practices which best accomodates the multiplicity of demands upon our resources and our environment. The plan is of such great importance to every single member of our society that it requires the opinions, ideas, plans and influence of every facet of that society.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Sub-Alpine Forest .... ▨
Montane Forest .... ■

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